COLLEGE CODE: 9133

COURSE:Internet Of Things(IoT)

PHASE 2: Innovation

PROJECT TITLE: Public transport optimization

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Indroduction :

Urban areas are facing escalating challenges related to traffic congestion, environmental sustainability, and the efficiency of public transportation systems. The current state of public transport falls short of meeting the growing demand for accessible, reliable, and sustainable mobility solutions. Inefficiencies such as irregular schedules, congested routes, and lengthy travel times have contributed to decreased ridership, increased traffic congestion, and adverse environmental impacts

Working :

Public transport optimization using the Internet of Things (IoT) involves the integration of IoT devices and data-driven technology into public transportation systems to enhance efficiency, safety, and the overall passenger experience.

IoT Devices and Sensors:

IoT devices and sensors are strategically deployed throughout the public transportation system. These devices can include:

GPS sensors on vehicles to track their real-time location and movement.

Passenger counters to monitor boarding and alighting.

Environmental sensors to assess air quality and weather conditions.

Vehicle health monitors to track maintenance needs.

Surveillance cameras for security and safety.
Smart ticketing systems for contactless payments

Real-Time Feedback:

Passengers and operators can access real-time information through mobile apps or displays at transit stations. Passengers can check when the next vehicle will arrive, while operators can monitor vehicle health and performance.

Data Collection:

These IoT devices continuously collect data from various points within the transportation system. The data is then transmitted to a central server or cloud-based platform in real-time or near real-time.

Passenger Engagement:

Through mobile apps and digital displays, passengers can access information about the transit system in real-time, plan their routes, and receive updates on delays and disruptions.

Safety and Security:

IoT-enabled surveillance cameras and emergency alert systems enhance passenger safety. Alerts can be sent to authorities in case of accidents or incidents, improving response time

Algorithmic overview:

Optimizing public transportation projects using IoT involves various aspects, such as vehicle scheduling, route optimization, demand forecasting, and real-time monitoring. Here's a high-level algorithmic overview of a public transportation optimization project using IoT:

Data Collection and Integration:

Collect data from IoT sensors on vehicles, stations, and other relevant points.
Integrate data from various sources, including GPS, passenger counts, weather conditions, and traffic data.

Passenger Information Systems:

Develop systems to provide passengers with real-time information about vehicle locations, delays, and alternative routes via mobile apps, digital displays, or public announcements.

Feedback Loops:

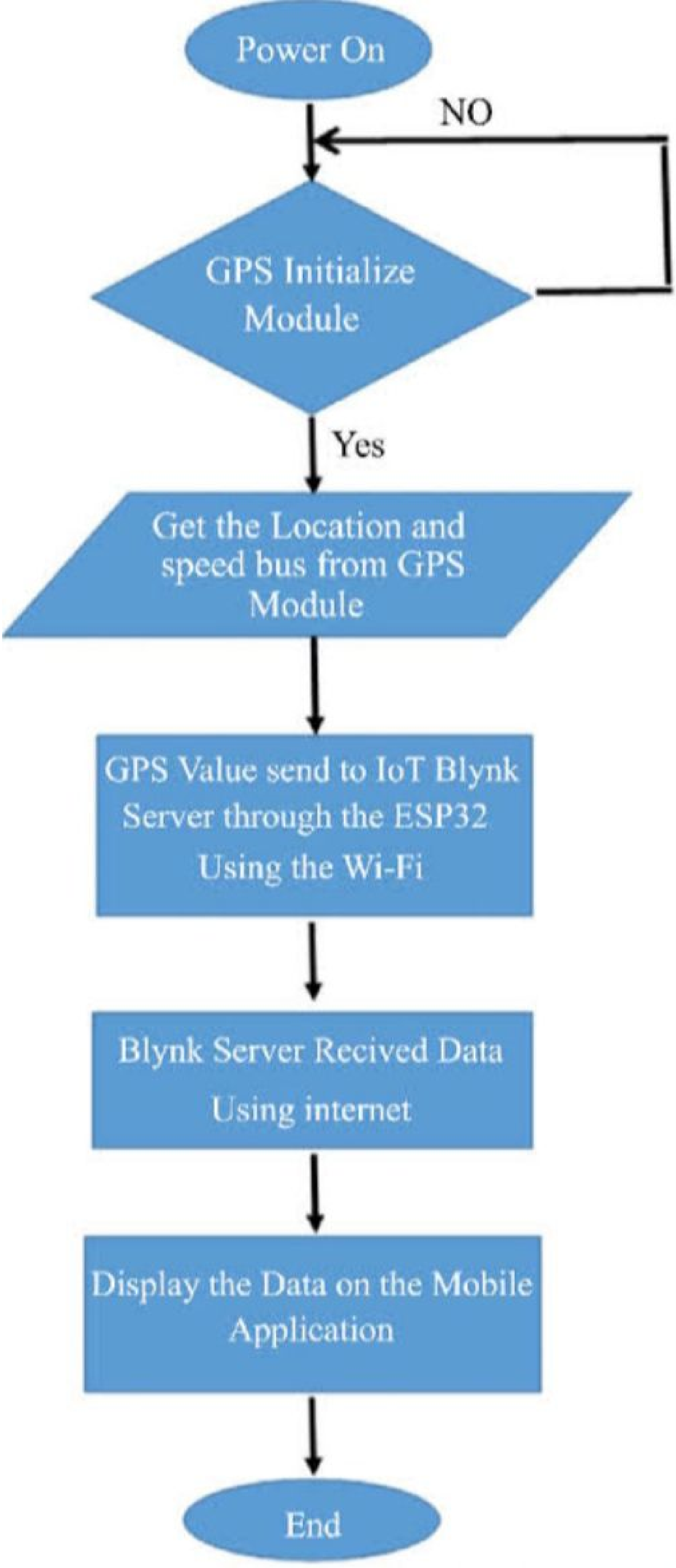
Continuously gather feedback from passengers and operators to improve the system further.Use machine learning algorithms to analyze feedback and make adjustments.

Adaptive Decision-Making:

Implement adaptive decision-making algorithms that can dynamically adjust the transportation system's parameters and strategies based on real-time data and changing conditions.

Flowchart:

In the flowchart that describes the proposed system work . A GPS module connected to an ESP32 Microcontroller with a built-in Wi-Fi module is placed inside each bus. When the power supply is on, the GPS module communicates continuously with the satellite to get coordinates.


Power On
NO
GPS Initialize Module
Yes
Get the Location and speed bus from GPS Module
GPS Value send to IoT Blynk Server through the ESP32 Using the Wi-Fi
Blynk Server Recived Data Using internet
Display the Data on the Mobile Application
End

The GPS module will initialize itself, then the module will get the coordinates, but if the coordinates are not received, then the module will initialize again. Once the GPS obtains the coordinates, it sends the data, including latitude and longitude, and speed to the IoT Blynk server through the ESP32. At the Blynk server, the latitude and longitude are extracted and used on the visual map in the Blynk application. The live location of the bus can be seen on the Google map. Continuous data digital updates such as speed, distance, and the arrival time of the bus are displayed on the mobile application

Result:

For testing the efficiency of the proposed system, the prototype has been installed (GPS unit and ESP32) inside a vehicle with supplied internet to use the possibilities offered by the Internet of Things. That vehicle roamed through multiple roads in Mosul city for several days and at different times, for collecting and recording data (latitude, longitude, speed, distance, and time of arrival). Depending on the system model, this information will be transmitted via a Wi-Fi internet connection to the Blynk server and then to the Android mobile
application.Below figure represents the result displayed in the end-users mobile application for the smart public transportation system.

No.	Date	Time	Distance (Km)	Average Speed (Km/h)	Arrival Time (minute)
1	15/3/2021	10:58:12 am	3.775 Km	49 Km/h	4.5 minute
2	15/3/2021	11:15:20 am	1.494 Km	59 Km/h	1.98 minute
3	15/3/2021	11:20:33 am	4.949 Km	60 Km/h	4.99 minute
4	21/3/2021	3:06:12 pm	9.450 Km	42 Km/h	11.340 minute
5	21/3/2021	3:12 :30 pm	6.618 Km	40 Km/h	7.94 minute
6	21/3/2021	3:16:33 pm	5.229 Km	31 Km/h	6.275 minute
7	21/3/2021	3:19:50 pm	2.237 Km	40 Km/h	3.63 minute
8	21/3/2021	3:23:13 pm	1.928 Km	49 Km/h	2.314 minute
9	24/3/2021	1:25:15 pm	10.500 Km	59 Km/h	12.6 minute
10	24/3/2021	1:25:50 pm	10..442 Km	64 Km/h	12.503 minute
11	24/3/2021	1:26::18 pm	10.398 Km	47 Km/h	12.478 minute
12	27/4/2021	11:35:24 am	2.229 Km	37 Km/h	3.6 minute
13	27/4/2021	11:36:26 am	2.130 Km	37 Km/h	2.972 minute
14	27/4/2021	11::37:17 am	1.432 Km	45 Km/h	1.998 minute
15	27/4/2021	11:37:58 am	0.938 Km	47 Km/h	1.309 minute

Application:

Real-time Tracking and Scheduling

Vehicle Tracking

Dynamic Scheduling

Passenger Information Systems

Mobile Apps

Digital Displays

Predictive Maintenance

Data Analytics and Decision Support

Benefits:

Enhanced urban mobility.
Reduced traffic congestion and air pollution.
Increased public transportation ridership.
Improved quality of life for residents

Conclusion:

The optimization of public transportation is essential to meet the growing demands of urban mobility, reduce environmental impact, and improve the overall quality of life for its residents. This project aims to address these challenges systematically and comprehensively to create a more sustainable and efficient public transport system.